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# TRIPLE PHASE MULTIDIMENSIONAL COMPUTED TOMOGRAPHY IN THE CHARACTERIZATION OF FOCAL HEPATIC LESIONS

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**ABSTRACT**

**Background :** Liver being one of the largest organ in the body is the site for a wide gamut of benign and malignant neoplasms. It is also one of the commonest sites for metastatic neoplasms for primary tumor elsewherePurpose of the study is to determine the value of various phases of triple helical CT, hepatic arterial phase (HAP), Portal venous phase (PVP) & equilibrium phase (EP), in the detection and characterization of hepatic lesions. Ability to reconstruct images at overlapping intervals and at very small intervals as small as 1 mm.

**Methodology :** Sixty eight patients with age range from 24 years to 77 years were evaluated and underwent MDCT examination for the evaluation of focal hepatic neoplasms.Results : Our study included 68 patients with hepatic neoplasms. Most common neoplasm was HCC which accounted for 41.1% of our cases followed by metastases which accounted for 20.5% and hemangioma which accounted for 11.7% and abscess and hepatic cyst which accounted for 7.3% and cholangio carcinoma which accounted for 4.4% and 1 case of FNH and Biliary cystadenoma which accounted for 1.4%.

**Conclusion:** In one of the study documented the difference seen in the no. of lesions detected during portal venous phase and other phases where lesions were less than 1-2 cm in size. Equilibrium phase is useful in characterization in cases of hemangioma, focal nodular hyperplasia and cholangio carcinoma and not in detection of additional lesions.

**KEYWORDS :**

## Introduction

Liver being one of the largest organ in the body is the site for a wide gamut of benign and malignant neoplasms. It is also one of the commonest sites for metastatic neoplasms for primary tumor elsewhere. Complex diffuse diseases like cirrhosis and chronic viral infections also affect it. The metabolic functions of the liver and its dual vascular supply have made the management of liver neoplasms a challenge to clinicians and surgeons. Prior to surgical treatment of liver tumors, it is important to detect, characterize, and accurately localize them. [1,2] Improved detection and characterization can help determine which hepatic tumors may be amenable to aggressive surgical techniques and which indicate palliative treatment. The characterization of liver lesions as malignant or benign is important for the correct triage of patients to surgical versus nonsurgical therapies.[3,4]

Ability to scan the liver during hepatic arterial phase [HAP], portal venous phase [PVP] of enhancement and the potential added value of delayed phase [DP] images increases the lesion conspicuity and boosts the diagnostic confidence. [5] Scanning the liver thrice sequentially allows detection of both hypervascular and hypovascular tumors. Purpose of this study is to characterize the hepatic masses depending on the pattern of enhancement and to make confident diagnosis. [6]

Purpose of the study is to determine the value of various phases of triple helical CT, hepatic arterial phase (HAP), Portal venous phase (PVP) & equilibrium phase (EP), in the detection and characterization of hepatic lesions. Ability to reconstruct images at overlapping intervals and at very small intervals as small as 1 mm.

## MATERIAL AND METHODS

Sixty eight patients with age range from 24 years to 77 years were examined with multiphase (Plain, hepatic arterial, portal venous and equilibrium phases) Multidimensional CT of liver. Of the 68 patients, 53 were males, 15 were females. Patients were referred for CT scans when, liver disease was suspected clinically, if ultrasound and other previous investigations revealed lesions which had to be further evaluated or characterized by MDCT and to detect liver metastases in a known case of primary extra hepatic malignancy, this could alter the patient's management.

**CT Technique :** Helical scanning of liver was performed with SIEMENS SOMATOM- 32 slice MDCT Machine. Images were reconstructed with multiplanar reconstruction. Number of lesions visualized in each phase is counted and lesions which are less than 2cms were noted. This study was conducted a prospective study of 68 patients who underwent MDCT examination for the evaluation of focal hepatic neoplasms. The diagnosis in these patients was obtained either by USG or CT guided FNAC/Biopsy, by typical imaging features or based on clinical and laboratory findings. Cases in which final diagnosis was not made by HPE / imaging or clinical data, were excluded from the study. [7,8]

## RESULTS

This was a hospital based prospective study conducted in the department of radiology, madha medical college and research institute, chennai from a period of Feb 2015 to Feb 2017. 68 Patients were included in the study. We categorized neoplasms into benign and malignant lesions. We encountered 461 malignant lesions and 46 benign lesions. MDCT evaluation of liver tumors was done in three phases – Arterial phase, Portal venous phase and delayed phase.

## CLINICAL SPECTRUM

**Table 1: Clinical Spectrum of hepatic neoplasms**

| Clinical presentation | No. of patients (n=68) |
|---|---|
| Pain abdomen | 42 (61.7%) |
| Abdominal Distension | 9 (13.2%) |
| Loss of weight | 36 (52.9%) |
| Jaundice | 5 (7.3%) |
| Hepatomegaly | 21 (30.8%) |
| Mass per abdomen | 7 (10.2%) |
| Ascites / Pleural effusion | 16 (23.5%) |

**Table : 2 Spectrum of hepatic neoplasms**

| Neoplams | No. of patients (n=68) |
|---|---|
| HCC | 28 (41.1%) |
| Metastases | 14 (20.5%) |
| Cholangio carcinoma | 3 (4.5%) |
| Hemangioma | 8 (11.8%) |
| Abscess | 5 (7.3%) |
| Hepatic cyst | 5 (7.3%) |
| Hydatid cyst | 3 (4.5%) |
| FNH | 1 (1.5%) |
| Biliary cystadenoma | 1 (1.5%) |
| | 68 |

**Table 3: Classification of various liver lesions detected by MDCT**

| Sl. No. | Diagnosis | No. of Patients | No. of Lesions |
|---|---|---|---|
| 1 | Hepatoma | 28 | 185 |
| 2 | Metastases | 14 | 273 |
| 3 | Cholangiocarcinoma | 3 | 3 |
| 4 | Hemangioma | 8 | 10 |

| | | | |
|---|---|---|---|
| **5** | Abscess | 5 | 11 |
| **6** | Hepatic cyst | 5 | 19 |
| **7** | Hydatid cyst | 3 | 4 |
| **8** | Biliary Cyst Adenoma | 1 | 1 |
| **9** | Focal nodular hyperplasia | 1 | 1 |
| **Total** | | 68 | 507 |

**Discussion:**

We conducted a prospective study of 68 patients who underwent MDCT examination for the evaluation of focal hepatic neoplasms. The diagnosis in these patients was obtained either by USG or CT guided FNAC/Biopsy, by typical imaging features or based on clinical and laboratory findings. Cases in which final diagnosis was not made by HPE / imaging or clinical data, were excluded from the study.

Our study included 68 patients with hepatic neoplasms. Most common neoplasm was HCC which accounted for 41.1% of our cases followed by metastases which accounted for 20.5% and hemangioma which accounted for 11.7% and abscess and hepatic cyst which accounted for 7.3% and cholangio carcinoma which accounted for 4.4% and 1 case of FNH and Biliary cystadenoma which accounted for 1.4%.Because of high frequency of occurrence of benign and malignant liver lesions, such as hemangiomas, HCCS and Metastases, characterization of these lesions is essential.Triple phase technique was used to image the entire liver in arterial, portal and equilibrium phases after obtaining NECT images of liver

Enhancement patterns :Numerous enhancement patterns of lesions were noted if the appearance of lesion in all 4 phases was considered. For example if a lesion is hypervascular it may appear hyperdense on hepatic arterial phase and portal venous phase images. Whereas another hypervascular lesion which is hyperdense on Hepatic arterial phase images may become hypodense on portal venous phase and equilibrium phase images[9,10,11].Numbers of studies have been done recently which showed improved lesion detection of hypervascular tumors if Hepatic Arterial phase scanning is performed in addition to portal venous phase scanning, however characterization of lesions has received less attention.186 lesions in 29 patients were hypervascular under category V & VI Pattern of enhancement. Out of 186 lesions 185 (99.46%) were malignant & 1(0.53%) were benign.[12,13,14]

Therefore in our study category V & VI patterns, which include homogenous hyperdense or heterogeneous hyperdense with nonglobular hyperdense areas, during Hepatic arterial phase, where found in malignant lesions, and homogenous hyperdense during HAP in a benign lesion.15,16

Out of 186 all the 185 lesions were hypervascular HCC. By putting together, category V & VI as nonglobular hyperattenuating pattern, this pattern was found to be 100% sensitive and 99.37% specific for HCC. Specificity is low because we encountered a case of hypervascular benign lesion of FNH. Among 46 benign lesions, 10 hemangiomas in this study were hypervascular. All 10 (100%) showed characteristic globular enhancement starting from the periphery.[17,18] Therefore globular enhancement (Isodense to aorta) (category I) was 100% sensitive and 100% specific for hemangioma.

In our study portal venous phase depicted. More hypovascular metastases. Sensitivity of portal venous phase for mets was 100% as there were no cases of hypervascular metastases. Out of 273 lesions, 29 (10%) were seen only on portal venous phase images and not seen on HAP images or NECT of these 18 lesions (6%) were less than 2 cms in size. Various studies [19,20,21] told about the sensitivity of arterial and portal venous phase in the detection of hypovascular metastases. Sensitivity of portal venous phase was 91%. In one of the study [22] documented the difference seen in the no. of lesions detected during portal venous phase and other phases where lesions were less than 1-2 cm in size. Equilibrium phase is useful in characterization in cases of hemangioma, focal nodular hyperplasia and cholangio carcinoma and not in detection of additional lesions.

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